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Forest Pest  
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Davis, CA

# Drop Size Spectra for Application of Thuricide 32LV with a Beecomist Atomizer





## **Drop Size Spectra for**

### **Application of Thuricide 32LV**

#### **with a Beecomist Atomizer**

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Drop Size Spectra for Application of Thuricide 32LV  
with a Beecomist Atomizer

PREFACE

The purpose of this wind tunnel test was to establish atomization characteristics of two tank mixes of Thuricide 32LV with the Beecomist<sup>R</sup> spray device at air velocities of 65 mph. Such data are used as input to mathematical models which predict spray coverage, canopy penetration, and off-target drift. Wind tunnel test data also are used to assist in the selection of nozzle types and orientation for specific applications. As an example, for effective use of Thuricide 32LV the volume median diameter should be around 100  $\mu\text{m}$  for application rates under 64 oz/acre. For a given aircraft speed which nozzle size and orientation should be used? Or in the case of rotary nozzles what are the rpm and flowrate settings for the desired drop size range? Wind tunnel tests help to provide these data to achieve specific droplet spectra and application rates.

Funding was provided by USDA Forest Service, Forest Pest Management, Washington Office. Questions and comments should be directed to the Project Officer, John W. Barry, 2810 Chiles Rd., Davis, CA 95616.

Wind tunnel data include data on the ratios of the atomized and unatomized Thuricide droplets from the ratio of the recovery stage droplets. The droplets were measured vertically at 8 radial positions representing total area ( $0.5 \text{ in.}^2$ ) in 16 concentric patterns. Droplet size frequency data from each pattern was combined into a single suspension distribution.

The atomizer was a Model 500 Beecomist unit with a perforated stainless steel screen. The flow rate was adjusted to 7.1 gpm by regulating the pressure in a Highmark Variable Restrictor valve. A Kynarair digital flowmeter was used to monitor the flowrate. A 30° cone spray unit was used to apply the 30° power cone to available aircraft boom/nozzle operating speeds.

The Thuricide 32LV material was applied with the desired amount of water and kept under constant vibration in a stainless steel six tank during the test period.



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Drop size spectra were analyzed with sprays containing two different concentrations of Thuricide 32LV and atomized with an electric powered Beecomist unit in a wind tunnel with an airspeed of 65 mph.

Equipment and Methods:

A laser beam droplet measurement system, PMS OAP-2D-GA1 with a PMS 11-C data acquisition system, was used in a 2 x 2 ft wind tunnel to measure the droplet size spectrum. Procedures were similar to previous protocol developed for measurement of rotary atomizers. Briefly the probe was mounted with the laser beam located 5.25 inches above the bottom of the wind tunnel test section and 10 inches downstream from the rear of the rotary cage atomizer. The atomizer was positioned vertically at 6 radial positions representing equal areas ( $85.28\text{ in}^2$ ) of the spray pattern. Droplet size frequency data from each segment was combined into a single composite distribution.

The atomizer was a Model 360A Beecomist unit with a perforated stainless steel sleeve. The flow rate was adjusted to 2.5 gpm by regulating the pressure on a Micronair Variable Restrictor Unit. A Micronair digital flowmeter was used to monitor the flowrate. A DC power supply was used to supply the DC power normally available on aircraft battery-alternator systems.

The Thuricide 32LV material was diluted with the desired amount of water and kept under constant agitation in a stainless steel mix tank during the test period.



Results:

Table 1 lists the calculated flowrate for the specified application parameters.

Table 2 lists the adjustment required for the desired flowrate.

Table 3 lists the summary of the drop size spectrums for the selected test conditions.

Tables 4 and 5 are the detailed drop size frequency tables and graphs for each spray mixture.

Nomenclature:

Diameter with 10% volume  $\leq D_{V0.1}$

Volume median diameter = VMD =  $D_{V0.5}$

Diameter with 90% volume  $\leq D_{V0.9}$

Number median diameter = NMD =  $D_{N0.5}$

$$\text{Relative Span} = \text{R.S.} = \frac{D_{V0.9} - D_{V0.1}}{D_{V0.5}}$$



Table 1

Flowrate Required for an Application Rate of 96 oz/acre and  
Selected Application Parameters

Airspeed <u>mph</u>	Swath <u>ft</u>	Total <u>gpm</u>	No. of spinners <u>No.</u>	Flowrate per spinner <u>gpm</u>
65	100	9.85	4	2.5

Table 2

Adjustments Required for Selected Flowrates

<u>Restrictor</u>	<u>Setting</u>	<u>Pressure</u>	<u>Flowrate</u>
Micronair VRU	11	28 psi	2.5 gpm

Table 3

Drop Size Spectrum with a Beecomist Model 360A Electric Atomizer,  
Perforated Stainless Steel Sleeve, at 28 volts D.C.

Part	Spray Mixture Thuricide:Part Water	Airspeed <u>mph</u>	Flowrate <u>gpm</u>	RPM	(VMD)			R.S.
					D <sub>V.1</sub> $\mu\text{m}$	D <sub>V.5</sub> $\mu\text{m}$	D <sub>V.9</sub> $\mu\text{m}$	
	1:1	65	2.5	8700	81	152	234	1.0
	1:2	65	2.5	8700	91	156	245	0.98



Table 4

Spray Mixture; 1 part Thuricide: 1 part Water

BEECOMIST, 65 MPH, 2.5 GPM, 8700 RPM, THURICIDE 32LV, 50% MIX

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DFM=1.0--2.8 MHz

UPPER LIMIT	N(RAW)	N/SEC	qm/SEC	% N		ACCUMULATED	
				% VOL.	% N	% VOL.	% N
56	2770	3.19E 08	10.50	73.49	7.05	73.49	7.05
89	1804	2.95E 07	5.86	6.79	3.94	80.27	10.99
122	2769	3.96E 07	24.07	9.12	16.16	89.40	27.15
154	2728	2.67E 07	36.58	6.15	24.56	95.55	51.71
187	2210	1.23E 07	31.80	2.83	21.35	98.38	73.06
219	1765	4.64E 06	20.28	1.07	13.61	99.44	86.67
252	1420	1.64E 06	11.20	0.38	7.52	99.82	94.19
284	903	594357	5.97	0.14	4.01	99.96	98.20
318	476	144960	2.08	0.03	1.40	99.99	99.60
351	156	25848	0.51	0.01	0.34	100.00	99.94
382	31	2779	0.07	0.00	0.05	100.00	99.99
414	6	654	0.02	0.00	0.01	100.00	100.00
447	0	0	0.00	0.00	0.00	100.00	100.00
TOTALS		4.35E 08	148.94				

TOTAL RAW PARTICLES.... 17038/21961-- 77.58%

NUMBER MEAN DIAMETER... 60.57 MICROMETERS S.D.... 40.40

VOLUME MEAN DIAMETER... 86.86 MICROMETERS S.D.... 120.55

SAUTER MEAN DIAMETER... 123.65 MICROMETERS

D <sub>No.1</sub> ...	0.00 MICROMETERS	D <sub>v0.1</sub> ...	81.00 MICROMETERS	
D <sub>No.5</sub> ...	0.00 MICROMETERS	D <sub>v0.5</sub> ...	152.31 MICROMETERS	R.S.... 1.00
D <sub>No.9</sub> ...	124.84 MICROMETERS	D <sub>v0.9</sub> ...	234.05 MICROMETERS	



Nozzle Type..... BEECOMIST  
 Nozzle Angle Rel.  
 to Airstream.....  $0^\circ$   
 Spray Pressure..... 28 PSI  
 Airspeed..... 65 MPH

Distance to Probe... 25 cm.  
 Depth of Field..... 1.0 cm.  
 Slice Rate..... 2.8 MHz  
 Date..... 84/06/06  
 Time..... 10:40:04  
 File Number..... 10.1.60

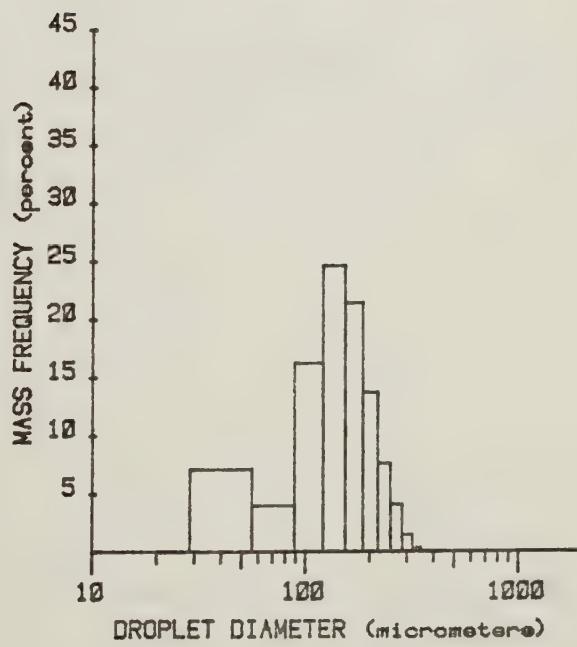
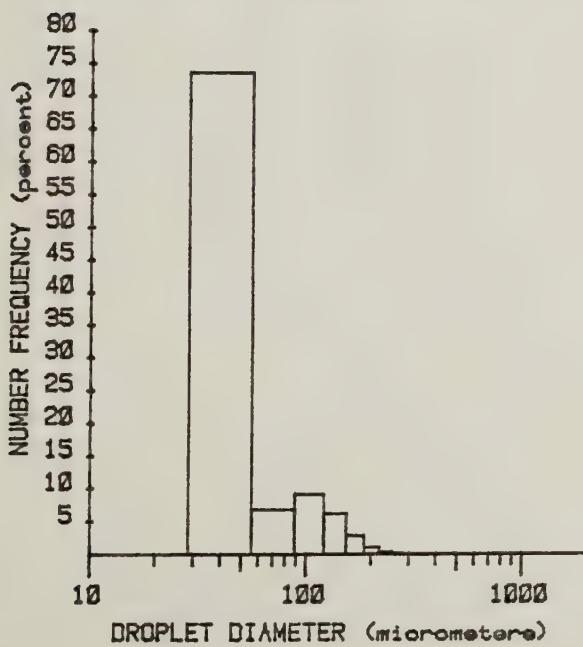
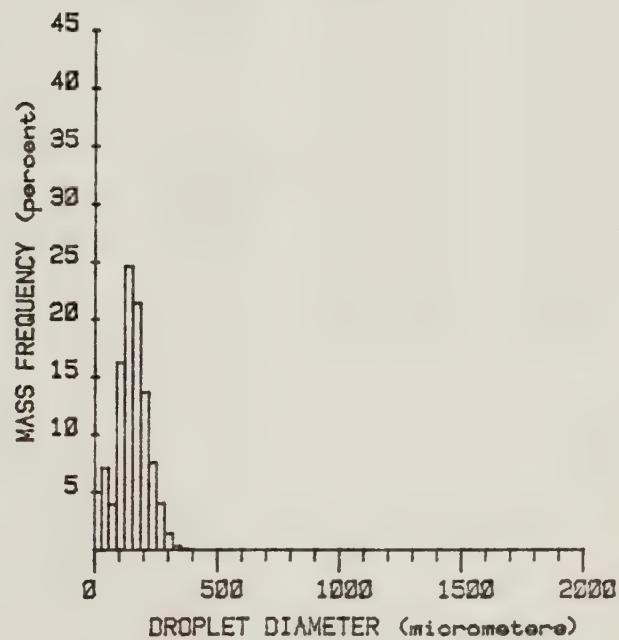
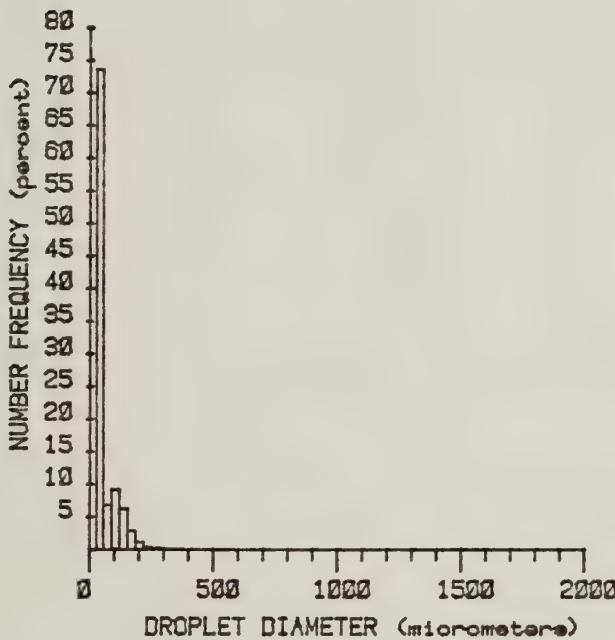
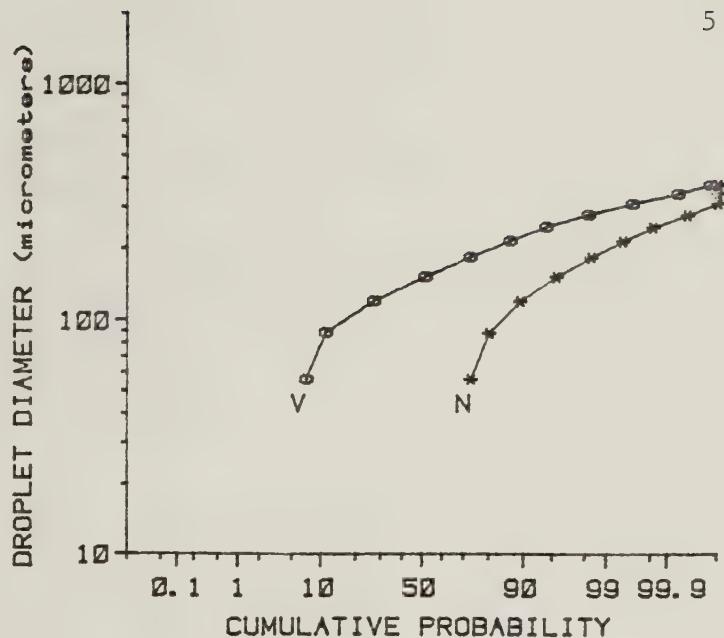




Table 5  
Spray Mixture, 1 part Thuricide: 2 part Water

BEECOMIST, 65 MPH, 2.5 GPM, 8700 RP 1, THURICIDE 32LV, 33% MIX

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DFM=1.0--2.8 MHz

<u>UPPER LIMIT</u>	<u>N(RAW)</u>	<u>N/SEC</u>	<u>T</u>	<u>gm/SEC</u>	<u>% N</u>	<u>% VOL.</u>	<u>% N</u>	<u>% VOL.</u>
56	2875	2.94E 03	9.68	70.84	5.80	70.84	5.80	
89	1615	2.57E 07	5.11	6.19	3.06	77.03	8.86	
122	2520	4.46E 07	27.06	10.72	16.21	37.75	25.07	
154	2166	2.87E 07	39.22	6.90	23.50	94.65	43.57	
187	2031	1.37E 07	35.61	3.31	21.33	97.96	69.90	
219	1690	5.67E 06	24.81	1.37	14.86	99.32	84.76	
252	1244	1.67E 06	11.38	0.40	6.82	99.73	91.58	
284	860	589659	5.92	0.14	3.55	99.87	95.13	
318	371	521692	7.50	0.13	4.49	99.99	99.62	
351	99	20972	0.41	0.01	0.25	100.00	99.87	
382	25	5611	0.14	0.00	0.09	100.00	99.95	
414	13	1744	0.06	0.00	0.03	100.00	99.99	
447	1	445	0.02	0.00	0.01	100.00	100.00	
479	0	0	0.00	0.00	0.00	100.00	100.00	
TOTALS		4.16E 03	166.92					

TOTAL RAW PARTICLES.... 15510/20726-- 74.33%

NUMBER MEAN DIAMETER... 63.56 MICROMETERS S.D.... 43.23

VOLUME MEAN DIAMETER... 91.57 MICROMETERS S.D.... 126.43

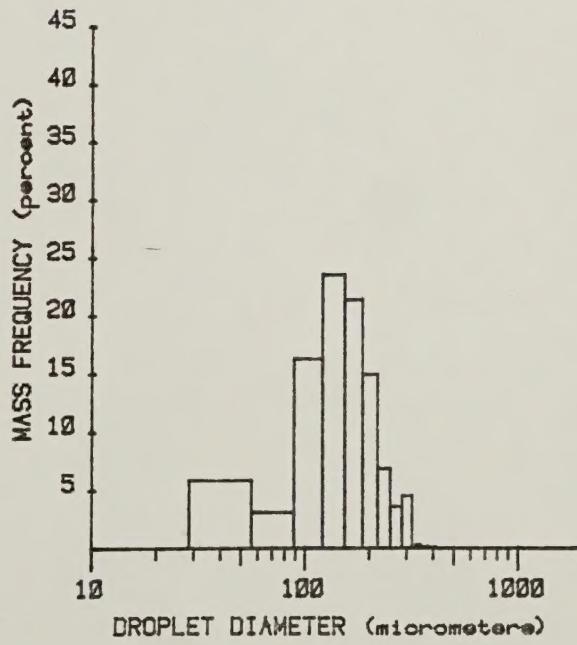
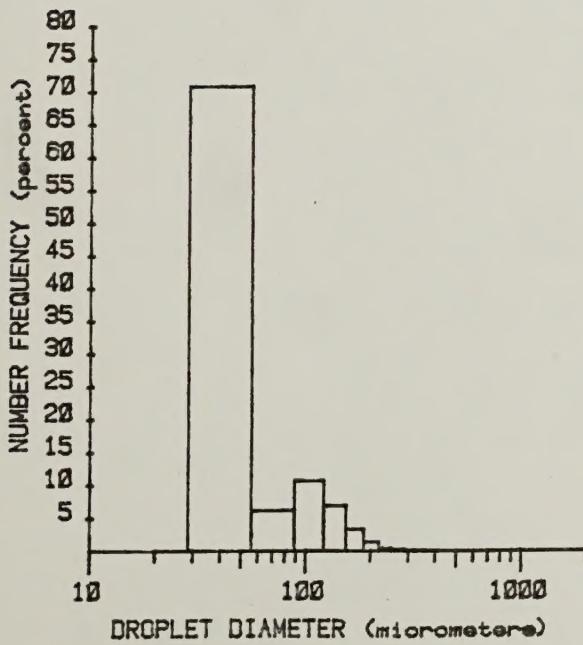
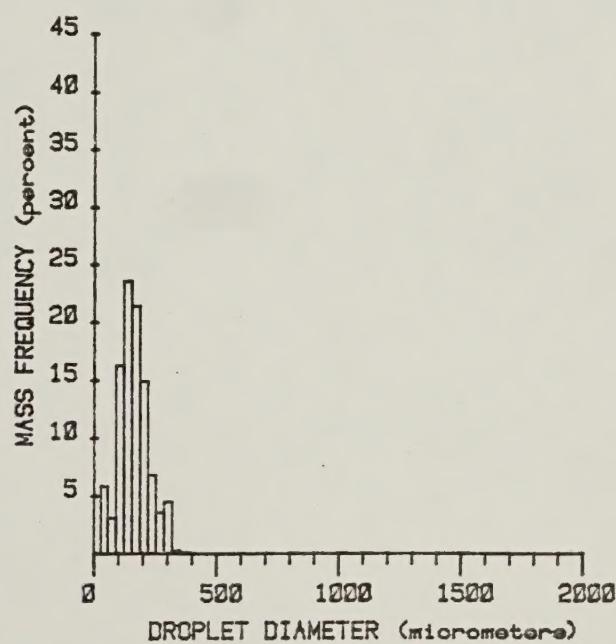
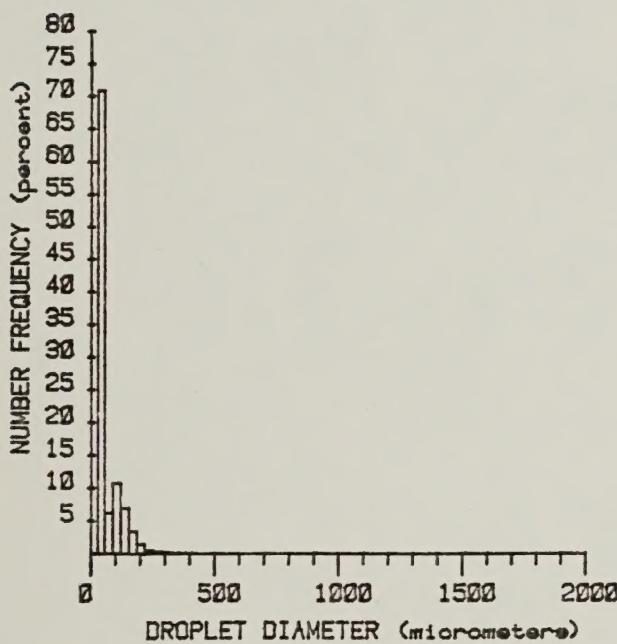
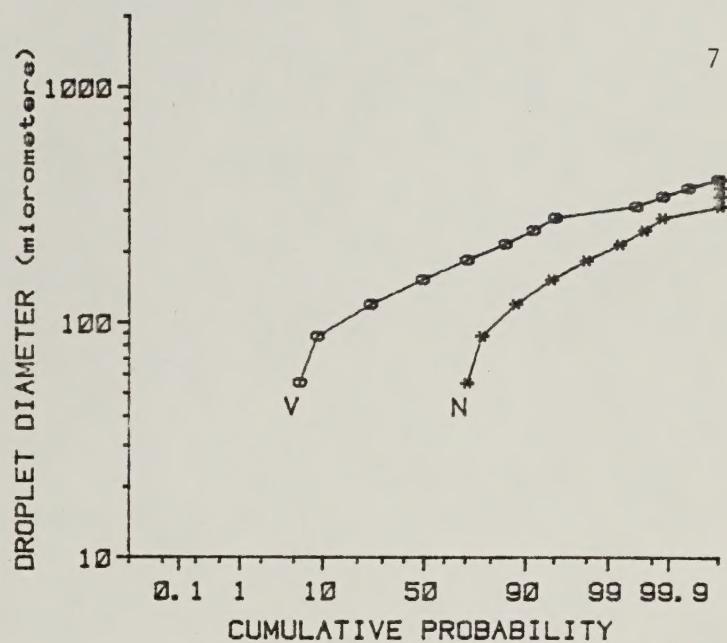
SAUTER MEAN DIAMETER... 129.95 MICROMETERS

D <sub>No.1</sub> ...	0.00 MICROMETERS	D <sub>v0.1</sub> ...	91.25 MICROMETERS	
D <sub>No.5</sub> ...	0.00 MICROMETERS	D <sub>v0.5</sub> ...	156.49 MICROMETERS	R.S.... 0.93
D <sub>No.9</sub> ...	132.36 MICROMETERS	D <sub>v0.9</sub> ...	244.79 MICROMETERS	



Nozzle Type..... BEECOMIST  
 Nozzle Angle Rel.  
 to Airstream.....  $0^\circ$   
 Spray Pressure..... 28 PSI  
 Airspeed..... 65 MPH

Distance to Probe... 25 cm.  
 Depth of Field..... 1.0 cm.  
 Slice Rate..... 2.8 MHz  
 Date..... 84/06/06  
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 File Number..... 10.1.60







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